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INFLUENCE OF EXPERIMENTAL HYPOKINESIA ON  
GASTRIC SECRETORY FUNCTION

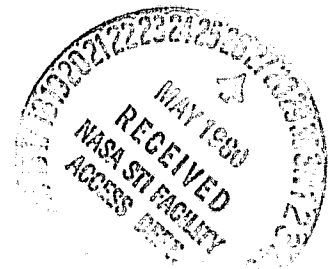
O.O. Markova, A.S. Vavryshchuk, V.I. Rozvodovs'ky  
and V.A. Proshcheruk

Translation of "Vplyv eksperymental'noyi gipokineziyi na  
sekretornu funktsiyu shlunka," Fiziolohichnyy zhurnal (Kiev),  
Vol. 23, No. 5, 1977, pp. 653-656

(NASA-TM-76034) INFLUENCE OF EXPERIMENTAL  
HYPOKINESIA ON GASTRIC SECRETORY FUNCTION  
(National Aeronautics and Space  
Administration) 8 p HC A02/MF A01

N80-23974

Unclas  
G5/52 19324



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
WASHINGTON, D.C. 20546

APRIL 1980

## STANDARD TITLE PAGE

1. Report No. NASA TM-76034	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle INFLUENCE OF EXPERIMENTAL HYPOKINESIA ON GASTRIC SECRETORY FUNC- TION		5. Report Date April 1980
		6. Performing Organization Code
7. Author(s) O.O. Markova, A.S. Vavryshchuk, V.I. Rozvodovs'kyi and V.A. Proshcheruk, Dept. of Pathological Physiol., Ternopol Medical Institute, Ternopol, USSR		8. Performing Organization Report No.
		10. Work Unit No.
9. Performing Organization Name and Address Leo Kanner Associates Redwood City, California 94063		11. Contract or Grant No. NASW-3199
		13. Type of Report and Period Covered  Translation
12. Sponsoring Agency Name and Address National Aeronautics and Space Adminis- tration, Washington, D.C. 20546		14. Sponsoring Agency Code
15. Supplementary Notes  Translation of "Vplyv eksperymental'noyi gipokineziyi na sekretornu funktsiyu shlunka," Fiziologichnyy zhurnal (Kiev), Vol. 23, No. 5, 1977, pp. 653-656		
16. Abstract  The gastric secretory function of rats was studied in 4, 8, 16 and 30 day hypokinesia. Inhibition of both the gastric juice secretory and acid producing functions was found. The greatest inhibition was observed on day 8 of limited mobility. By days 16 and 30 of the experiment, a tendency of the gastric secretory activity to return to normal was observed, though it remained reduced.		
17. Key Words (Selected by Author(s))		18. Distribution Statement
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19. Security Classif. (of this)		
Unclassified	Unclassified	8

## INFLUENCE OF EXPERIMENTAL HYPOKINESIA ON GASTRIC SECRETORY FUNCTION

O.O. Markova, A.S. Vavryshchuk, V.I. Rozvodovs'kyi  
and V.A. Proshcheruk  
Dept. of Pathological Physiology, Ternopol  
Medical Institute, Ternopol, USSR

The problem of hypokinesia is important to the extensive clinical practice, since the ill usually are constrained by a bed regimen for a certain period of time. /653\*

The question of the effect of hypokinesia on the nervous, cardiovascular, endocrine and locomotor systems, immunobiological protective responses and metabolism have been dealt with extensively in the literature. The effect of hypokinesia on the digestive system has not yet been explained adequately.

Study of the gastric secretory and acid production functions can produce the effects of changes in the stomach. Explanation of these processes can assist in making up proper diets for the ill and, also, in the development of preventive treatment preparations directed toward the maintenance of normal functions of the gastrointestinal tract in a long term bed regimen. In recent years, there have been indications of disturbance of the digestive system as a result of limitation of motor activity in the literature [3, 8].

We studied the pattern of changes of the gastric secretory function in 30 day hypokinesia.

### Method

Five series of studies were conducted on 62 random bred white rats of both sexes, weighing 150-220 g. The animals of control series I were in conventional vivarium cages, and the other four series had preliminary limitation of their motor activity for 4, 8, 16 and 30 days. To produce

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\*Numbers in the margin indicate pagination in the foreign text.

hypokinesia, the rats were placed in specially constructed metal group cages with individual sections. The cage design permitted their volume to be changed to correspond to the size of the rat, by which the standardization of the conditions of their maintenance is increased.

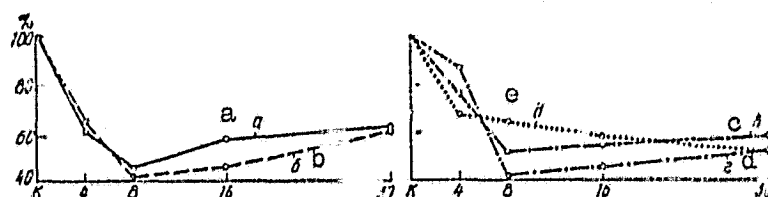
The food and drink containers were placed in the front part of the cage. The animals were fed bread and milk. The gastric juice was obtained in an acute study [9]. Eighteen days before the start of the study, bread feeding of the rats was stopped, with unlimited access to water. Then, under urethane anesthesia (250 mg/kg intraperitoneally), the animals were fixed, back down, to a stand with rubber bands. A cylinder was placed under the back. The hair of the upper part of the abdomen in the epigastric region was shaved, and a 1.5-2.0 cm incision was made in all layers of the anterior abdominal wall. A ligature was applied between the pylorus and the duodenum. Here, care was taken not to injure or tie the vessels. The animals were in this condition for 2 days. Forceps then were applied to the esophagus, the stomach was removed, and it was washed in physiological solution and dried. All the contents of the stomach then were removed. The amount of gastric juice was measured in ml during the 2 day tie off. The acidity of the gastric juice (total, free, bound) was determined microchemically [1]. The study results were processed by the generally accepted methods of the statistics of variation.

### Results and Discussion

The study results are presented in the table, from which it is evident that, in hypokinesia, the gastric secretion is depressed. The volume of the gastric secretion on the fourth day of limited mobility decreases by 39%. On day 8, the amount of gastric secretion decreases further (by 55%, compared with the control). Subsequently, a tendency of the gastric secretion to return to normal is observed, but it remained reduced. On day 16 of the study, the amount of gastric juice secreted was 42% below normal. On day 30 of hypokinesia, the gastric secretion level was lower than the control by 39% ( $p < 0.05$ ). The acid production function of the stomach (see figure) also was observed during hypokinesia. We observed a 35% decrease of total acidity of the gastric juice on the

/654

fourth day of observation. The most marked decrease in total acidity was observed on days 8 and 16 of hypokinesia. On day 8, total acidity decreased by 59% and, on day 16, by 55% below normal. Subsequently, on day 30 of hypokinesia, some tendency towards an increase in total acidity was observed, but it remained 39% below the control values.



Changes of gastric secretory activity in percent in experimental hypokinesia: ordinate, average secretory activity indices; a. amount of gastric juice; b. total acidity; c. total hydrochloric acid; d. free and e. bound hydrochloric acid; abscissa, day of hypokinesia; K, control.

#### AVERAGE INDICES OF GASTRIC SECRETORY ACTIVITY OF RATS IN CONTROL AT DIFFERENT TIMES OF HYPOKINESIA

Умови дослідження	Кількість гіперсекреції соку, виділеної за 1 год, у мл	С загальної кислоти	д вільної НСІ	е вся кількість НСІ	ф зв'язана НСІ
г Контроль	1,54±0,220	83,31±3,055	29,19±2,569	63,74±2,832	34,87±2,309
h Гіпокінезія, 4 дні	0,94±0,118	54,40±8,134	25,42±2,225	48,67±2,534	23,25±2,098
p	<0,05	<0,001	>0,05	<0,01	<0,01
h Гіпокінезія, 8 днів	0,70±0,222	34,54±1,688	12,09±1,507	32,94±7,030	22,34±0,995
p	<0,01	<0,001	<0,001	<0,001	<0,001
h Гіпокінезія, 16 днів	0,90±0,469	37,81±1,785	12,70±3,858	34,43±1,876	20,24±3,001
p	<0,05	<0,001	<0,302	<0,001	<0,002
h Гіпокінезія, 30 днів	0,95±0,049	51,20±4,797	15,01±1,510	36,85±3,262	17,83±2,638
p	<0,05	<0,001	<0,001	<0,001	<0,001

Key: a. Study conditions e. Total HCl  
b. Amount of gastric juice secreted per day, ml f. Bound HCl  
c. Total acidity g. Control  
d. Free HCl h. Hypokinesia, 4, 8, 16, 30 days

In prolonged hypokinesia, depression of hydrochloric acid production also is observed. On day four of hypokinesia, there was a significant 24% decrease in total amount of hydrochloric acid, which was

greater than the amount of bound hydrochloric acid ( $p < 0.01$ ). A decrease in concentration of free hydrochloric acid in this period was significant ( $p < 0.05$ ). At later times in hypokinesia, the indices of both the free and bound hydrochloric acid decreased significantly, which was evidence of considerable weakening of the secretory ability of the surrounding cells. Thus, after 8 days of hypokinesia, the concentration of free hydrochloric acid decreased by 59% and that of bound, by 36%. On days 16-30 of hypokinesia, some tendency was observed towards an increase in concentration of free hydrochloric acid, but it was 56% and 49% below normal, respectively. The concentration of bound hydrochloric acid at these observation times always was reduced, and it was 49% below the control on day 30.

Thus, our studies show that, in hypokinesia, there is depression of both the gastric secretory and acid production functions, and the greatest depression of it was observed on day 8 of limited mobility.

It is evident from the literature that, as a result of 15 day hypokinesia of people, with a single meal of preserved foodstuffs, a 45% reduction in gastric secretory activity was observed and, against the background of this decrease, a 32% increase in the indices of bound acidity and a 50% increase in free hydrochloric were observed [4]. In study of the effect of hypokinesia, together with acceleration, on the human body, there is a decrease in both the gastric secretory and acid production functions [2, 4-6]. There also is a decrease in the enzyme secretion function of the pancreas in limitation of the motor activity of rats [7]. Apparently, changes of the secretory activity of the intestinal glands observed by many authors are associated with both decreases in muscle activity and with unusual diets, change in its amount and qualitative composition and, besides, as a result of exposure of the human body to such an extreme factor as acceleration. The changes we found in the secretion of gastric juice evidently are associated with a reduction of the influx of stimuli from the receptors of the motor analyzer to the central nervous system. In turn, this leads to weakening of the efferentation, which may be a cause of the depression of the gastric secretory and acid production functions.

Some tendency of the secretory activity to return to normal, observed after 30 day hypokinesia, can be considered a sign of adaptation of the body to unusual living conditions.



## REFERENCES

1. Gorbenko, F.G., "Microchemical determination of total acidity and free hydrochloric acid in the stomach contents," Klinich. meditsina 10, 48-50 (1953).
2. Yegorov, L.I., K.V. Smirnov, M.M. Korotayev and M.V. Lukasheva, "The effect of some extreme actions on the functional state of the stomach," Kosmich. biol. i med. 2, 71-74 (1967).
3. Krasnykh, I.G. and L.A. Tyutina, "The motor evacuation function of the gastrointestinal tract of the dog under conditions of prolonged hypodynamia," Kosmich. biol. i med. 5, 40-44 (1973).
4. Lukasheva, M.V., "The secretory function of the stomach of healthy people under normal conditions and in exposure to some extreme space flight factors," author's abstract of candidate's dissertation, Moscow, 1968, 14 pp.
5. Smirnov, K.V., L.S. Potemkina, L.G. Goland and A.G. Barakov, "The effect of transverse accelerations on the secretory activity of the gastrointestinal tract of the dog," Kosmich. biol. i med. 4, 29-33 (1964).
6. Smirnov, K.V., L.S. Potemkina, L.G. Goland, N.P. Goncharova, F.A. Semenova and V.I. Lechen'kov, "The effect of space flight on the state of the enzyme secretion function of the digestive systems of cosmonauts," Kosmich. biol. i med. 6, 61-65 (1970).
7. Smirnov, K.V., L.G. Goland and I.L. Medkova, "The effect of limitation of motor activity on the enzyme secretion function of the pancreas and the external secretory function of the liver of the rat," Kosmich. biol. i med. 3, 22-26 (1974).
8. Sorokin, P.A., V.V. Simonenko and B.A. Korolev, "Clinical observation of prolonged hypodynamia," Probl. kosmich. biol. 12, 24-33 (1969).
9. Shay, H., S.A. Komarov, S.S. Fels, D. Meranze, M. Gruenstein and H. Siplet, "A simple method for the uniform production of gastric ulceration in the rat," Gastroenterology 5, 43-61 (1945).

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